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| AUTHOR | Rittenhouse, Robert K. |
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ABSTRACT

The paper reviews the literature and proposes a study on how nonlanguage deaf/blind children (ages 2 to 14) match and classify, the age at which the skills are reached, and the role of language in the process. The theories of J. Piaget and J. Bruner on the importance of language in stage development are explored. The Ss would be matched for age (in six 2 year groupings) with deaf/blind children with receptive/expressive language skills. S. Wolff's "Games Without Words" will be used with modifications as they are constructed on Piagetian lines and have been field tested with deaf children. It is expected that the results of the experiment could provide additional supporting evidence for either Bruner's or Piaget's theory relative to the importance of language in moving a child from a sensorimotor stage to a stage of concrete operations. (PHR)

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# COGNITIVE DEVELOPMENT IN DEAF-BLIND CHILDREN

Robert K. Rittenhouse, Ph.D.
Assistant Professor of
Special Education

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INTRODUCTION

The purpose of this paper is not to argue for or against a particular theoretical viewpoint on cognitive development; but rather to discover how deaf-blind children, with limited or no language skills, develop concepts; the age at which particular concepts appear to be established; and the importance of language in conceptualization. This third point, the importance of language in conceptualization, may indeed provide additional evidence in support of either Piaget or Bruner theory on the importance of language in stage development.

It is prevalent to find deaf-blind children mistakenly described as one might describe a deaf child who is blind or a blind child who is deaf; as if the disabilities of deafness and blindness in combination somehow equal two. One would not make the mistake of suggesting that a skilled football player, having lost a leg, becomes a skilled, one-legged football player; that a gifted, concert pianist, having lost an arm, is simply reduced to a one-armed concert pianist; or that a popular novel, minus the climax, remains a popular novel less one chapter. So it is with deaf-blindness; that rather than having an additive effect, this disability has one of multiplying dimensions. It is the multiple effect of this disability which makes cognitive development a difficult area to study; but an area in which study must begin.

In order to understand the complexity of the problem, it is necessary to be familiarized with the dimensions of the handicap. Because the term deaf-blind has become a rather convenient, all-encompassing term used to classify all children with combination hearing-vision handicaps irrespective of the degree of the disability, this paper will be limited as much as possible to those children who have hearing and vision deficits as a result of rubella, or more commonly called German Measles. The rubella epidemic of 1964-65, as it swept across the nation, left a tragic toll upon an estimated 5,000 infants born with the following handicaps: cataracts, hearing defects, heart malformations, mental retardation and brain damage. (Dantona, 1970)

When some women contract this otherwise harmless disease during the first trimester of their pregnancy, the fetus is often severely damaged by the virus. Mill and his associates say that major fetal defects occur in 50% of the cases where the mother contracted the disease in the first month of pregnancy, 25% when the disease was contracted in the second month, 17% in the third month and 0% in the fourth month. Only those organs whose cells are in active division at the time of infection are damaged. Many of the child's most serious defects are not evident for months or years. (Guldager, 1970)

Rubella, deaf-blind children typically have some sight, but have glaucoma and/or cataracts necessitating frequent and often unsuccessful eye surgery. If they have been successfully operated on for cataracts, they may be very slow in learning to use their newly acquired vision. They may enjoy some forms of vision, particularly light gazing. This may become an obsession with the child and he may expend all his energy seeking light sources. The deaf-blind child is rarely profoundly deaf. He may appear deaf, but occasionally respond to very soft noises. Or he may respond to absolutely no noise, even extremely loud noises which deaf people can typically hear. He may enjoy certain sounds and they may become an obsession in much the same way as light gazing. In 1967, using an EEG to test auditory-evoked responses, eleven rubella infants who gave no behavioral responses to sound, were found to have residual hearing present as evidenced by EEG responses. (Guldager, 1970)

Although the deaf-blind youngster initially presents a picture of a child deficient in vision and hearing with associated motor delays and cardiac problems, further analysis introduces the question of whether they are able to utilize any of the sensory input systems beyond the grossest levels. Observations of limited use of tactile-kinesthetic, gustatory and olfactory systems suggest

that integrative learning is not spontaneously developed at even the lowest level. Much of what is observed in children as normal development, never emerges in these youngsters. (Stein, 1970)

THEORETICAL BACKGROUND

It seems essential to explore concept development in deaf-blind children within a Piagetian framework. While partial theories of learning and cognitive development have been introduced and substantiated, some surviving, some decaying, the work of Jean Piaget has stood the test of time. It is against his work that other theories are measured. His concerns with the development of the human child were primarily with intelligence; with cognition and intellectual processes.

Intelligence is measured by the individual's ability to use his adaptive skills to interact with his environment. Intellectual skill is increased as the child develops varied relationships with his environment. Full participation on the part of the child suggests that the sensory modalities, most especially the auditory and visual, be stimulated; and that their working together will help develop more stable or lasting concepts or schema which can then be called upon at a later time to generalize on new environmental situations.

This tenet has, of course, great implications for deaf-blind children. The tools so necessary for concept development are absent.

Thus, the ability to develop and further concepts is greatly limited. Absent these two most vital sensory input channels deaf-blind children are unable to fully participate in the interactive process termed assimilation-accomodation. (Piaget, 1970) They must fall back on the tactual-kinesthetic sense as the most reliable channel for learning and supplement this sensory input with whatever information might be received via the gustatory and olfactory channels. (Alpern, 1967) For deaf-blind children, the usual supplementary sensory input channels have become primary. However, these secondary channels cannot be expected to carry signals as strong and defined as are carried through the auditory and visual systems. In addition, the coordination, elaboration and generalizing of the information received is greatly limited because of inadequacy of the child's language system. In a study of cross modal transfer with first graders, Pick has evidence suggesting that in multidiscrimination learning, intermodal transfer appears to occur. The blindfolded children after tactilly differentiating two stimuli, could make distinctions visually. (Gibson. 1967) For purposes of this research, Pick's data is significant because it implies that symbols can be formed from tactilly-received information.

While Piaget, Bruner and Vygotsky have differing opinions on the role language plays in a child's development and the point at

which it becomes crucial, they all agree that language greatly enhances interaction with and understanding of the environment, and is a necessary tool for adult thinking. While the importance of an intact visual system cannot be minimized, auditorially-based language is the most important tool. In a simple conservation task with blind and sighted children, it was found that blind children conserve in the same order as sighted children. (Gottesman, 1973) Directions and the task manipulations were explained orally. Implicit in this experiment is the importance of language. Conversely, in testing for the effects of hearing loss on performance on a cognitive-based, motor-kinesthetic task, it was found that deaf children perform as well as hearing children whose language skills were superior to those of the deaf youngsters. (Beutler, 1970) The implication of this study would seem to be that once a minimum language base is reached, certain cognitive-based, motor-kinesthetic tasks can be performed with an equal degree of success, irrespective of the language skills of the individual.

Piaget regards the growth of intellect as sequential and hierarchical. Each succeeding stage must be built on a foundation of the prior stage. No true development of intelligence can take place without the prerequisites of preceeding levels. Each level of development is characterized by a series of psychological structures. These structures, in a sense, exhibit a balance between the

individual's mental actions and his environment, and are termed equilibrium. (Flavell, 1963) Equilibration is most important during the transitional periods as the child moves between various substages and between stages of development. At these points, the child is in a state of relative disequilibrium. Resolution of this disequilibration leads to stage and substage advancement or competence. (Bruner, 1956) For nonlanguage, deaf-blind, children, this conflict between self and environment is seldom resolved. Necessary precursors never emerge because of insufficient experience. Piaget explains that development may be horizontal as well as vertical and uses the term decalage to identify this concept. Concepts or schemas may combine and generalize upon a new but similar experience. If this generalization occurs within a stage it is said to be a horizontal decalage. If the child should generalize to a new and more complicated task which requires a much higher level of cognition and which is clearly a task which requires operations of a more advanced stage, it is said to be a vertical decalage. (Flavell, 1969) It is much more common for normal children to generalize within a stage than to perform operations of a more advanced stage. In his initial work with mentally retarded individuals and, most recently, with deaf-blind adolescents, Gold has found that deaf-blind adolescents were

able to assemble a 12 piece bicycle brake and, once the specific skill was learned in sequence, maintain this skill. (Gold, 1974) The bicycle brake is disassembled into its 12 component parts; each part is placed on a tray in sequential order and the subject is required to reassemble it. Training precedes the actual test. During the training session, each deaf-blind subject is tactilly guided through the process step-by-step. The ability to then assemble the brake requires more than rote motor movements. Concepts of in-out, loose-tight and correct-incorrect positioning are necessary. Even though the parts are in a sequential order, the individual must necessarily have an understanding of where he left off and where he is to begin. From what is known of the subjects, it appears they were functioning within the sensorimotor stage; however, were able to perform concrete operations, or cognitive operations of a more advanced stage, in assembling Gold's bicycle brake. Vertical decalage might explain away this single occurance; however, if Gold's subjects are able to perform a number of similar tasks, it would be evidence that deaf-blind individuals, through intense training, can perform certain cognitive operations beyond the sensorimotor stage while operating on a sensorimotor level in their day-to-day encounters.

Piaget makes frequent references to the integration of reflexes resulting in habits, to the integration of schemas, to the integration

of signifiers with experience, to the integration of symbols with symbols and to the manipulation and integration of two or three or more concepts simultaneously. Responses of increasing multiplicity and complexity are indications of behavior becoming increasingly integrated, thereby indicating the presence of higher level intellectual structures. In assembling Gold's bicycle brake, the deaf-blind subjects performed a number of well-coordinated motor acts which required that certain concepts be brought to bear upon the task. While it cannot be said that these concepts were coordinated; that in order to assemble the brake, the subjects had to manipulate and integrate a number of concepts simultaneously; neither can such multiple-cognitive operations be ruled out. In a study comparing motoric and verbal responses on a Piagetian rate-time task, second graders were able to imitate movement and time significantly more accurately than nursery school students, although they were not able to justify verbally significantly better than the preschoolers. (Longbordi & Wolff, 1973) The experiment involved both groups moving cars along a track at varied speeds, following the experimenters' demonstration and then justifying why one car went faster than or arrived before the other car. The authors felt that this was evidence that the older children possessed a motoric competence which allowed them to discriminate and to code the experimenters' performance. This study suggests that motor acts might be indicants of

higher level cognitive development. Adams has set forth a similar postulate: that the human learning of a motor act involves the influence of nonmotor response classes; that response systems interact and that the motor system is controllable by the verbal system. (Adams, 1971, p. 115)

Piaget's approach to language is basically that of a tool to intellect, founded upon a base of experience, but also structuring it defining it, assisting in the organization and distancing from the direct experience and becoming the instrument in later stages of symbolic manipulations. (Furth, 1969) Language is one of several different forms of symbolic activity. The child in his usage of objects and in his play, gives other behavioral evidence of symbolic process. In the broadest sense, Piaget's symbol refers to anything which represents something a person knows. In normal babies, prelanguage symbolism is usually recognized by the adult. For example, crying in the morning usually signifies a wet diaper and hunger pains. With nonlanguage, deaf-blind children, their overt gestures do not appear to have meaning. Frequently, while it is difficult to associate the overt gesture to a particular desire on the part of the child, it seems that he/she does indeed want something and is attempting to express this. If it could be discovered how nonlanguage or prelanguage deaf-blind children do symbolize or conceptualize, it might help shed light on this particular problem area.

For the normal, young child, while his symbol usage may be egocentric and narrow, the acquisition of language has enormous intellectual significance. Language helps propel him from the sensorimotor stage to the stage of operational thinking. For Vygotsky, language is a channeling device which advances concepts. Prior to conceptual structures, language has the role of internalizing dialogue into inner speech and thought. Once conceptual structures have been established, language is the analytic tool in thinking. (Vygotsky, 1962)

Bruner views language as synonomous with thought. Without language, the child shall always operate at a sensorimotor level, unable to propel himself into an operational stage. While Piaget states that a child does not need language to advance to concrete-operational stages, Bruner states he does. For Bruner, this stage is called functional, but it has the same behavioral characteristics as Piaget's concrete-operational stage. Ability to perform within the sensorimotor boundaries is not critically influenced by language according to both Piaget and Bruner. However, Adams postulates that motor learning in the sensorimotor stage is dependent on verbal feedback which he terms knowledge of results (KR). (Adams, 1971) Results of a number of experiments give evidence that when verbal KR is withdrawn, motor performance diminishes. (Schmidt & White, 1973 and Goetz, 1973) Adams' theory and subsequent supporting evidence link language

and motor performance in such a way that motor performance is dependent upon language.

STATEMENT OF THE PROBLEM

With minimal or no language, deaf-blind children are obviously going to be functionally limited. Information received via the tactile, olfactory and gustatory channels will necessarily be weak; and without intervention this information cannot be unified in a manner which will promote generalization. Even with appropriate intervention and subsequent conceptualization, it is difficult for deaf-blind children to coordinate concepts for purposes of generalizing because of their severe language limitations.

Further, the necessary research on this population has not been carried out. Data is available on the deaf population and the blind population, but when totalled sheds very little light on the deaf-blind population and the problems of understanding cognitive development within that population.

HYPOTHESIS

Nonlanguage deaf-blind children and deaf-blind children with minimal language skills have matching and classification skills which are developed tactilly. The ability of the children to use concrete operations to solve matching and classification tasks is related to their language ability.

THE EXPERIMENT

Three observations will be made from the resultant data of this experiment:

1) How nonlanguage, deaf-blind children match and classify.
2) The age at which these skills appear to be reached.
3) Does language appear to influence matching and classifying?

Subjects

Twelve subgroups of five subjects each will be used. All subgroups will have the following commonalities:

1) Congenital disabilities or disabilities which occurred during the first year of life.
2) Hearing loss will be bilateral and in the severe range.
3) Maximum visual acuity will be 20/200 in the better eye. (Acuity may be judged on a behavioral basis.)

The twelve subgroups will be divided into two major groups and will be matched by age as follows:

1) Subgroups 1 - 2-4
2) Subgroups 2 - 4-6

3) Subgroups 3 - 6-8

4) Subgroups 4 - 8-10

5) Subgroups 5 - 10-12

6) Subgroups 6 - 12-14

The principal difference between Group I and Group II will be the language ability of the subjects. The subjects in Group I will have no or limited receptive language skills and the subjects of Group II will have receptive-expressive language skills. It is anticipated that the subjects of Group II will have very limited expressive language skills; however, their receptive skills will be sufficiently superior so as to discern them from subjects of Group I. A questionnaire will be developed for teachers to assess the language ability of the subjects. This questionnaire will be constructed in consultation with teachers of deaf-blind children. It is anticipated that the term language will be translated to the term vocabulary in the process of assessing language skills and, therefore, criterion for grouping will be number of words in the subject's working vocabulary.

It is also anticipated that the visual ability of subjects of Group II (language) will be better than those of Group I (non-language). Wherever possible, this discrepancy will be minimized. An imaginary control group, derived from the literature, will be established.

Tasks

Matching and classification tasks from Wolff's Games Without Words have been modified in order to present them to deaf-blind children. Wolff's games have been constructed on a Piagetian construct and field tested with deaf children. (Wolff, 1974)

One matching task (C) and one classification task (B) require concrete operations for successful completion. Sufficient practice trials will be allowed in order to ensure that each subject understands what is expected of him. For subjects in Group I (nonlanguage), it is anticipated that a training period using rewards will be necessary for each subject . For subgroups 1 and 2 of Group II (language), a training period will be necessary; however, the remaining subgroups of Group II should understand directions through simple demonstration.

Matching Tasks

Matching Task A: Each subject will be presented with 3 circle, 3 triangle and 3 square, same-color/size blocks which will be placed to his/her right. In front of the subject will be a box with a circle, triangle and square slot in the lid. The subject will be expected to place the blocks in the appropriate slots. This exercise will be repeated 3 times, alternating the order of the slots in the box lid in order

to determine if the subject is matching according to shape or order.

EXPECTED RESULTS: Subgroups 2-6 of both groups will successfully match, and will match according to shape.

Matching Task B: Each subject will be given 4 triangle, 4 circle and 4 square, same-color/size blocks which will be placed to his/her right. Two blocks of each set will be textured. To subject's left will be identical blocks. Subject will be expected to appropriately match blocks according to size and texture.

EXPECTED RESULTS: Subgroups 2-6 of both groups will successfully match and will match according to shape and texture.

Matching Task C: Each subject will be presented with 5 paired items familiar to the subject. The 5 paired items will include, but not be limited to: spoon-plate, sock-shoe, toothbrush-toothpaste, belt-slacks and two familiar school or play items. Teachers will be consulted to be sure that each subject has some familiarity with the paired items. The items will be divided into two groups and the subject will be expected to match them.

EXPECTED RESULTS: Subgroups 2-6 of Group II (language) will successfully match. All subgroups of Group I (nonlanguage) will fail to match.

Classification Tasks

Classification Task A: Each will be presented with 5 triangle, 5 circle and 5 square, same-color, differing size blocks which will be placed to his/her right. A large, circular table with slots for triangle, circle and square blocks will be placed in front of the subject. The slots will match in size with the blocks as follows: circle-triangle, triangle-square and square-circle. The subject will be expected to classify according to shape.

EXPECTED RESULTS: Subgroups 2-6 will successfully classify, and will classify according to shape.

Classification Task B: Each subject will be presented with 20 items which correspond in equal distribution to the following 4 rooms: (1) bedroom, (2) bathroom, (3) playroom and (4) kitchen. (When testing occurs in a residential school, it may be necessary to eliminate the kitchen classification.) The subject will be expected

to classify each item in the appropriate room by placing the item in the corresponding room.

EXPECTED RESULTS: Subgroups 3-6 of Group II (language) will successfully classify. All subgroups of Group I (nonlanguage) will fail to classify.

Scoring

Each task will require that subjects correctly match or classify without error in order to reach success level. Techniques for matching and classifying will be recorded in order to see if any pattern emerges for those subjects who fail. Data from available literature will be accumulated to compare against the results of Groups I and II.

To test the significance of the difference between Group I and Group II, T-tests will be used on the performance scores of both groups. A one way analysis of variance will be performed on the data from Group I, Group II and the control group in order to identify significant differences between the three groups.

Discussion

In order to solve matching task A and B and classification task A, a child need not be in a stage beyond the sensorimotor level. However, in order to achieve success on matching task C and

classification task B, a child must be able to perform concrete operations.

Results of the experiment could provide additional supporting evidence for either Bruner or Piaget's theory relative to the importance of language in moving a child from a sensorimotor stage to a stage of concrete operations. Should the results come out as expected, Bruner's theory that language is necessary in order to perform concrete operations would be supported.

A nonlanguage, deaf-blind individual who functions at a sensorimotor level for several years is not the same person who performs at this level for 18-24 months as does the normal child. While the nonlanguage 14 year old deaf-blind adolescent may not demonstrate concrete operations on matching and classification tasks, he/she may be able to perform what appear to be cognitive-based, complex motor tasks.

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